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TABLES AND INSTRUCTIONS FOR USE WITH LATEX HYDROMETER.

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Although, in some cases, hydrometers are made with direct readings of the substance to be estimated on the stem, it was thought more desirable in the construction of a hydrometer for the estimation of the rubber content of Hevea latex, to have the instrument graduated in density figures on the stem and to issue a table with each instrument.

Several scientific apparatus makers issue special hydrometers graduated at 84° F for use in the tropics, since it is often impossible, even in a laboratory in the tropics, to reduce the temperature of the liquid to be tested to 60° F (= 15° C) the temperature at which most densities are calculated in temperate climates, in comparison with distilled water which is taken as 1·0000 at that temperature; with instruments which are graduated at 84° F, the density of the liquid is compared with water, which is taken as 1·0000 at 84° F, which is found to be approximately the average shade temperature in the factory or laboratory in this country.

Each hydrometer should therefore float, if correct, with the lowest mark, which represents pure water (density = 1·0000) coinciding with the surface of the water. Theoretically, distilled water should be used, but most waters in this country contain such a small quantity of dissolved solids, that the instrument can be tested in ordinary water, as the error thus introduced is so small. The small bulb at the bottom of each instrument is screwed to the instrument and contains a small cavity which can be loaded. The

bulb is usually loaded with shots; if the instrument is too heavy, *i.e.* the lowest division (1·0000) sinks below the surface of the water being tested, shot must be removed, whereas, if the instrument is too light, small shots or small particles of lead may be added. It is preferable however to ask for scientific advice if the instrument is incorrect.

Instructions for Reading Instruments.

The instrument of the latest type is graduated from 0·9800 to 1·0000 which represents a rubber content of latex varying from about 33 per cent to zero, the figure 0·9800 representing latex containing 33 per cent of dry rubber and the figure 1·0000 representing pure water. The total density range for 33 per cent of rubber is therefore only 0·02.

The instrument has been tested against estimations made in a special specific gravity bottle with a stopper having a capillary tube and cover, which enables very accurate measurements to be made. The writer's instrument was found to give results agreeing exceedingly well with the determinations made with the bottle.

Only a few actual figures are marked on the stem of the instrument thus, 980, 5, 990, 5, 1·00. These figures respectively mean 0·9800, 0·9850, 0·9900, 0·9950 and 1·0000. Each of the larger divisions corresponds to 0·001 and each of the smaller divisions to 0·0002 or one-fifth of the larger divisions. All the graduations on the stem are given in the following table, which it is hoped will be sufficiently explanatory. As will be seen from the table, three of the smallest divisions represent 0·0006 which corresponds to a difference of 1 per cent in the rubber content, *i.e.* each small division representing 0·0002 corresponds to 0·33 per cent of rubber.

Table I. gives the density figures and the corresponding rubber content in direct percentage or grammes per 100 cubic centimetres and also in pounds of dry rubber per gallon of latex.

Table. II. is published to enable any planter to dilute his latex to three definite fixed standards. *i.e.* a latex giving 2 lbs., 1½lbs., or 1¼ lbs. of dry rubber per gallon. With the present methods of coagulation etc., it would be advisable if all estates worked to the same standard dilution of latex, as in this way a step towards the standardisation of First Quality sheet would be made. Thus, assuming that the density of the latex as brought to the factory from the field is 0·9850, (a latex of this density, as per Table I contains 25 per cent or 2·5 lbs. of dry rubber per gallon) and it is required to add water, so that each gallon of latex shall contain 1½ lbs. of dry rubber per gallon, it is necessary

to add 5·3 pints or 5 pints 6 ozs. of water to each gallon of the latex or 53 pints (= 6 gallons 5 pints) to every 10 gallons of the latex. I do not wish it to be assumed that I am in favour generally of the dilution of latex; in the preparation of sheet of good appearance, free from air bubbles, "coagulation" marks etc., some dilution is necessary and a latex giving 1½ lbs. of dry rubber per gallon is not excessively diluted (the effect on the quality of the rubber of this dilution, which amounts usually to about equal volumes of pure latex and water, will be tested shortly). Although a third column has been added in which latex is diluted to give 1¼ lbs. of dry rubber per gallon (a dilution practised on some estates), dilution to this extent is not recommended, as it is unnecessary in the preparation of First Quality Sheet.

Table III. is given, on account of the fact that this method of working is adopted on some estates; that is, in order to make a sheet of standard size and weight, each lot of latex is tested by various methods and such a quantity taken in each coagulating pan as will give a sheet of the desired weight. (*N.B.* This method cannot be carried to the extent of the dilution given in the table.) A factor, is introduced in such a process, which is undesirable, *viz.* that of variable concentration, which, even though it may not be very large, probably influences the quality of the rubber. This method is therefore not recommended, especially since the method recommended under Table II, although it introduces dilution of the latex, allows the latex to be reduced always to a standard density from which the coagulated rubber must be constant in quality, if the same method of coagulation is maintained throughout, and the same period of smoking or other treatment to which the rubber may be subjected, as far as possible.

As I have pointed out in previous notes on this instrument (Vide A. B. Vol. II Nos. 9 & 11) it is not advisable to use the hydrometer direct for a density much below 0·9850, even though it is graduated to 0·9800, since latex containing approximately 25 per cent of rubber or more is somewhat viscous, and accurate readings cannot be made. In such cases, equal quantities of latex and water are mixed carefully and the density read off, the rubber content corresponding to this being doubled to give the true percentage in the original latex. Thus, assuming the latex brought to the factory has a density of 0·9838 which corresponds to 27 per cent or 2·7 lbs. per gallon of dry rubber, this figure may be more than 1 per cent in error due to the viscosity of the latex; on diluting the latex with an equal part of water the density became say 0·9930 which from Table I corresponds to 1 lb. 5·3 ozs. of rubber, per gallon of latex; the rubber content of the original latex is there-

fore 2 lbs. 10·6 ozs. or 2·66 lbs. per gallon (= 26·6 per cent) ; this figure is therefore the more accurate; dilution with an equal part of water is merely recommended as being the simplest procedure. Only sufficient latex need be taken so that after dilution with an equal volume of water, there is sufficient in which to float the instrument. If a cylindrical glass vessel of about 3 inches diameter and 10 inches deep is used, as small a quantity as 18 ozs. of latex may be used. The amount of latex actually taken for the test does not affect the result, as long as sufficient is present in which to float the instrument. In order to obtain the total rubber yield per plot or per acre etc. the volume of the latex, as well as the density, must, of course, be known.

The instrument is of use in several ways *e.g.* if tapping experiments are being conducted, instead of weighing up all the rubber from each experiment and keeping the latex separate, the density and the volume of the latex can be taken, and the latex then bulked. Similarly if the yields on certain divisions or plots on an estate are required, similar measurements may be made and the latex subsequently bulked. At present on many estates the latex from different fields is coagulated separately in order to ascertain variations in yields; this separation usually means a variation in the quality of the rubber from such divisions or fields. The daily crop of First Quality rubber can also be ascertained immediately after the latex is received in the factory. The instrument should be washed carefully in water immediately after use, and dried with a soft cloth. The writer will be pleased to give personal advice or further information if application be made to the Director of Agriculture when any difficulty arises.

TABLE I.

Density of latex.	Dry rubber per cent or grammes per 100 ccs.	Dry rubber per gallon.
9820	30·0	3·0 lbs. = 3 lbs. 0 ozs.
9822	29·6	2 „ 15·5 „
9824	29·3	2 „ 14·9 „
9826	29·0	2·9 „ 2 „ 14·4 „
9828	28·6	2 „ 13·9 „
9830	28·3	2 „ 13·3 „
9832	28·0	2·8 „ 2 „ 12·8 „
9834	27·6	2 „ 12·3 „
9836	27·3	2 „ 11·7 „
9838	27·0	2·7 „ 2 „ 11·2 „
9840	26·6	2 „ 10·6 „

9842	26·3		2	„	10·1 „
9844	26·0	2·6 „	2	„	9·6 „
9846	25·6		2	„	9·0 „
9848	25·3		2	„	8·5 „
9850	25·0	2·5 „	2	„	8·0 „
9852	24·6		2	„	7·4 „
9854	24·3		2	„	6·9 „
9856	24·0	2·4 „	2	„	6·4 „
9858	23·6		2	„	5·8 „
9860	23·3		2	„	5·3 „
9862	23·0	2·3 „	2	„	4·8 „
9864	22·6		2	„	4·2 „
9866	22·3		2	„	3·7 „
9868	22·0	2·2 „	2	„	3·2 „
9870	21·6		2	„	2·6 „
9872	21·3		2	„	2·1 „
9874	21·0	2·1 „	2	„	1·6 „
9876	20·6		2	„	1·0 „
9878	20·3		2	„	0·5 „
9880	20·0	2·0 „	2	„	0 „
9882	19·6		1	„	15·4 „
9884	19·3		1	„	14·9 „
9886	19·0	1·9 „	1	„	14·4 „
9888	18·6		1	„	13·9 „
9890	18·3		1	„	13·3 „
9892	18·0	1·8 „	1	„	12·8 „
9894	17·6		1	„	12·2 „
9896	17·3		1	„	11·7 „
9898	17·0	1·7 „	1	„	11·2 „
9900	16·6		1	„	10·6 „
9902	16·3		1	„	10·1 „
9904	16·0	1·6 „	1	„	9·6 „
9906	15·6		1	„	9·0 „
9908	15·3		1	„	8·5 „
9910	15·0	1·5 „	1	„	8·0 „
9912	14·6		1	„	7·4 „
9914			1	„	7·0 „
9916	14·0	1·4 „	1	„	6·4 „
9918			1	„	5·8 „
9920			1	„	5·3 „
9922	13·0	1·3 „	1	„	4·8 „
9924			1	„	4·2 „
9926			1	„	3·7 „
9928	12·0	1·2 „	1	„	3·2 „

9930				1 „	2·6	„
9932				1 „	2·1	„
9934	11·0	1·1	lbs. =	1 lbs.	1·6	ozs.
9936				1 „	1·0	„
9938				1 „	0·5	„
9940	10·0	1·0	„	1 „	0	„
9942					15·4	„
9944					14·9	„
9946	9·0	0·9	„		14·4	„
9948					13·8	„
9950					13·3	„
9952	8·0	0·8	„		12·8	„
9954					12·2	„
9956					11·7	„
9958	7·0	0·7	„		11·2	„
9960					10·6	„
9962					10·1	„
9964	6·0	0·6	„		9·6	„
9966					9·0	„
9968					8·5	„
9970	5·0	0·5	„		8·0	„
9972					7·4	„
9974					6·9	„
9976	4·0	0·4	„		6·4	„
9978					5·8	„
9980					5·3	„
9982	3·0	0·3	„		4·8	„
9984					4·2	„
9986					3·7	„
9988	2·0	0·2	„		3·2	„
9990					2·6	„
9992					2·1	„
9994	1·0	0·1	„		1·6	„
9996					1·0	„
9998					0·5	„
1·0000	0·0	0·0	„		0	„

Table II.

Density of Latex	Volume of water required per gallon of latex to produce a latex yielding :—.								
	(*a*) 2 lbs per gallon			(*b*) 1½ lbs. per gallon			(*c*) 1¼ lbs per gallon		
	pints.	pints.	ozs.	pints.	pints.	ozs.	pints.	pints.	ozs.
9820	4· 0 =	4—	0	8 =	8—	0	11· 2 =	11—	4
9822	3·84	3—	17	7· 8	7—	16	11· 0	11—	0
9824	3· 7	3—	14	7· 6	7—	12	10· 7	10—	14

9826	3· 6	3—12	7· 5	7— 9	10·55	10—11
9828	3·44	3— 9	7· 2	7— 5	10· 3	10— 6
9830	3· 3	3— 6	7· 1	7— 1	10· 1	10— 3
9832	3· 2	3— 4	6· 9	6—18	9· 9	9—18
9834	3· 0	3— 1	6· 7	6—14	9· 7	9—14
9836	2· 9	2—18	6· 5	6—11	9· 5	9—10
9838	2· 8	2—16	6· 4	6— 8	9· 3	9— 6
9840	2·64	2—13	6· 2	6— 4	9· 0	9— 0
9842	2· 5	2—10	6· 0	6— 0	8· 8	8—16
9844	2· 4	2— 8	5· 8	5—16	8· 6	8—12
9846	2·24	2— 5	5· 6	5—12	8· 4	8— 8
9848	2· 1	2— 2	5·45	5— 9	8· 2	8— 4
9850	2· 0	2— 0	5· 3	5— 6	8· 0	8— 0
9852	1·84	1—17	5· 1	5— 2	7· 8	7—16
9854	1· 7	1—14	4· 9	4—18	7· 6	7—14
9856	1· 6	1—12	4·75	4—15	7· 4	7— 8
9858	1·44	1— 9	4· 6	4—12	7· 2	7— 4
9860	1· 3	1— 6	4· 4	4— 8	7· 0	7— 0
9862	1· 2	1— 4	4·25	4— 5	6· 7	6—14
9864	1·04	1— 1	4· 1	4— 2	6· 5	6—10
9866	0· 9	18	3· 9	3—18	6· 3	6— 6
9868	0· 8	16	3· 7	3—14	6· 1	6— 2
9870	0·64	13	3· 5	3—10	5· 9	5—18
9872	0· 5	10	3·35	3— 7	5· 7	5—14
9872	0· 5	10	3·35	3— 7	5· 7	5—14
9874	0· 4	8	3· 2	3— 4	5· 4	5— 8
9876	0·24	5	3· 0	3— 0	5· 2	5— 4
9878	0· 1	2	2· 8	2—16	5· 0	5— 0
9880	0· 0	0	2· 6	2—12	4· 8	4—16
9882			2·45	2— 9	4·55	4—11
9884			2· 3	2— 6	4· 3	4— 6
9886			2· 1	2— 2	4· 1	4— 2
9888			1· 9	1—18	3· 9	3—18
9890			1· 7	1—14	3· 7	3—14
9892			1·55	1—11	3· 5	3—10
9894			1· 4	1— 8	3· 2	3— 4
9896			1· 2	1— 4	3· 0	3— 0
9898			1·05	1— 1	2· 8	2—16
9900			0· 9	18	2· 6	2—12
9902			0· 7	14	2· 4	2— 8
9904			0· 5	10	2· 2	2— 4
9906			0· 3	6	2· 0	2— 0
9908			0·15	3	1· 8	1—16
9910			0· 0	0	1· 6	1—12

9912	1· 4	1— 8
9914	1· 2	1— 4
9916	1· 0	1— 0
9918	0· 8	0—15
9920	0· 6	0—12
9922	0· 3	0— 6
9924	0·05	0— 1
9926	0· 0	0— 0

Table III.

Density of Latex.	Volume of latex required to yield					
	(*a*). 2 lbs of dry rubber		(*b*) 1½ lbs of dry rubber		(*c*) 1¼ lbs of dry rubber	
	pints	pints ozs.	pints	pints ozs.	pints	pints ozs.
9820	5·33 =	5— 7	4· 0 =	4— 0	3·33 =	3— 6
9822	5·40	5— 8	4·04	4—08	3·37	3— 7
9824	5·46	5— 9	4·09	4—18	3· 4	3— 8
9826	5· 5	5—10	4·15	4— 3	3·45	3— 9
9828	5·65	5—11	4·18	4—36	3· 5	3—10
9830	5· 6	5—12	4·25	4— 5	3·53	3—10·6
9832	5·70	5—14	4· 3	4— 6	3·57	3—11
9834	5·75	5—15	4·34	4— 7	3·62	3—12
9836	5·85	5—17	4· 4	4— 8	3·66	3—13
9838	5· 9	5—18	4·44	4— 9	3· 7	3—14
9840	6· 0	6— 0	4· 5	4—10	3·76	3—15
9842	6·05	6— 1	4·55	4—11	3· 8	3—16
9844	6·15	6— 3	4· 6	4—12	3·84	3—17
9846	6·25	6— 5	4· 7	4—14	3· 9	3—18
9848	6·35	6— 7	4·75	4—15	3·95	3—19
9850	6· 4	6— 8	4· 8	4—16	4· 0	4— 0
9852	6· 5	6—10	4·85	4—17	4·06	4— 1
9854	6· 6	6—12	4· 9	4—18	4· 1	4— 2
9856	6·66	6—13	5· 0	5— 0	4·17	4— 3
9858	6·75	6—15	5·07	5—14	4·23	4— 5
9860	6·85	6—17	5·14	5—28	4· 3	4— 6
9862	6·95	6—19	5· 2	5— 4	4·34	4— 7
9864	7·05	7— 1	5· 3	5— 6	4· 4	4— 8
9866	7·15	7— 3	5·38	5—76	4·45	4— 9
9868	7·26	7— 5	5·48	5— 9	4· 5	4—10
9870	7· 4	7— 8	5·54	5—10·8	4· 6	4—12
9872	7· 5	7—10	5· 6	5—12·0	4·69	4—14
9874	7· 6	7—12	5· 7	5—14	4·76	4—15
9876	7· 7	7—14	5· 8	5—16	4·85	4—17

9878	7·85	7—17	5· 9	5—18	4· 9	4—19
9880	8· 0	8— 0	6· 0	6— 0	5· 0	5— 0
9882	8·15	8— 3	6· 1	6— 2	5· 1	5— 2
9884	8· 3	8— 6	6· 2	6— 4	5· 2	5— 4
9886	8·45	8— 9	6· 3	6— 6	5·26	5— 5
9888	8· 6	8—12	6· 4	6— 8	5· 4	5— 8
9890	8·75	8—15	6·54	6—10·8	5·46	5— 9
9892	8· 9	8—18	6·66	6—13	5·55	5—11
9894	9·05	9— 1	6· 8	6—16	5· 7	5—14
9896	9·25	9— 5	7· 0	7— 0	5· 8	5—16
9898	9· 4	9— 8	7·06	7— 1	5· 9	5—18
9900	9· 6	9—12	7· 2	7— 4	6· 0	6— 0
9902	9· 8	9—16	7·35	7— 7	6· 1	6— 2
9904	10· 0	10— 0	7· 5	7—10	6· 2	6— 4
9906	10· 2	10— 4	7·65	7—13	6· 4	6— 8
9908	10·45	10— 9	7· 8	7—16	6· 5	6—10
9910	10· 7	10—14	8· 0	8— 0	6·66	6—13
9912	10· 9	10—18	8· 2	8— 4	6· 8	6—16
9914	11·15	11— 3	8· 4	8— 8	7· 0	7— 0
9916	11· 4	11— 8	8·57	8—11	7· 1	7— 2
9918	11· 7	11—14	8· 8	8—16	7·34	7— 7
9920	12· 0	12— 0	9· 0	9— 0	7· 5	7—10
9922	12· 3	12— 6	9· 2	9— 4	7· 7	7—14
9924	12· 7	12—14	9· 5	9—10	8· 0	8— 0
9926	13· 0	13— 0	9· 7	9—14	8· 1	8— 2
9928	13· 3	13— 6	10· 0	10— 0	8· 3	8— 6
9930	13· 8	13—16	10·34	10— 7	8· 6	8—12
9932	14· 1	14— 2	10· 6	10—12	8· 8	8—16
9934	14· 5	14—10	10· 9	10—18	9· 1	9— 2
9936	15· 1	15— 2	11· 3	11— 6	9· 4	9— 8
9938	15· 5	15—10	11·64	11—13	9· 7	9—14
9940	16· 0	16— 0	12· 0	12— 0	10· 0	10— 0

Note:—In the above tables, the maximum rubber content included is 30 per cent corresponding to a density of0·9820, although the maximum reading obtainable on the instrument is 33·33 per cent corresponding to the lowest density figure on the scale *viz.* 0·9800.

As there are only a few figures engraved on the stem, which may not be understood properly, it may be necessary to explain their significance.

The lowest figure given is 980 which means 0·9800. The smallest divisions correspond to 0·0002, so that the divisions read as in the tables above 0·9800, 0·9802, 0·9804, 0·9806, 0·9808, 0·9810, etc., etc.

REPORT ON LOCUST WORK MAY 1st TO JULY 5th.

BY F. W. SOUTH.

SELANGOR.

In the report published in the June number of the *Agricultural Bulletin* it was stated that the eggs and very young hoppers of an intermediate generation began to appear around Kuala Lumpur at the end of April. These were the offspring of two big flying swarms which appeared unexpectedly during the month of April. The origin of these swarms was stated to be uncertain, but it was suggested that they were connected with two big swarms that were lost sight of near Klang Gates and Dusun Tua earlier in the year. There is, however, a reasonable possibility that they came up from the Negri Sembilan and the fact that their breeding season exactly corresponds with that of the majority of the Negri Sembilan swarms lends some support to this theory.

The period from May 4th to June 30th was fully occupied with the destruction of the hoppers of this intermediate generation and this was only just concluded at the end of June. The district in which the insects appeared was a long belt of country running from Klang Gates through Ampang, and the Rifle Range, to the Circular Road near the Race Course, the Race Course itself and the Forest Reserve near it as far as Ulu Pudu. Other swarms were found on Bungsar Estate, in the Public Gardens, near the Agricultural Department and over the hills as far as Batu Road.

There were several points of interest about this generation. It was found in certain localities, notably on the Race Course, that when a group of swarms had been nearly destroyed a new group would hatch out without the laying of any additional eggs. This seems to point to some delay in the hatching of the eggs. These delayed swarms were found to appear in some instances three weeks and in others as much as six weeks after the earlier swarms in the same localities had first been observed. It is practically certain that all the eggs were layed at the same time, as coolies were working continuously in all the localities and yet no flying locusts were observed to be laying there after those that layed the first batches of eggs.

Another point of interest was the successful employment of poison in dealing with some of the swarms. This was the first occasion on which poison had been used successfully in Selangor.

The results obtained may be summarised as follows.

May 4-May 15	2,037 tins	68 swarms
May 16-May 31	6,367 tins	154 swarms
June 1-June 15	11,209 tins	257 swarms
June 15-June 30	9,291 tins	307 swarms
	28,904 tins	786 swarms

The maximum number of gangs employed on any one day was 13, but throughout the period from 9 to 13 gangs were employed every day. About 6,000 kerosene tins full of locusts were destroyed on the Race Course alone.

Only one swarm escaped from this generation and that entered the jungle near Klang Gates and could not be dealt with in any way. Of the flying swarms that escaped from the previous regular generation of February and March hoppers there are two small swarms one at Rawang and one at Serendah with a somewhat larger one near Ulu Yam. Three others are known in the Sungei Besi, Pudu neighbourhood, while round Kajang the number varies as the swarms cross and recross the Negri Sembilan boundary. In all there are about 14 swarms mostly small which may be expected to lay eggs about the end of July. There should not be much difficulty in destroying practically all the offspring of these swarms. It is, however, always uncertain when the situation may be complicated by the appearance of large swarms from the Negri Sembilan.

NEGRI SEMBILAN.

In the Negri Sembilan the work of locust destruction was continuous in all three districts from the end of April to the end of May when it ceased in the Tampin district. In this last there was a well marked hopper season extending from April 1st to June 6th. In the other two districts work was continuous until the end of June, ceasing in the Seremban district on June 27th but continuing in the Coast to July 5th when the number of swarms of hoppers was very small. In the Seremban district the hopper season was continuous from March 30th to June 27th and it would appear that two generations have overlapped in this district. In the Coast the generations have become so intermixed that hoppers are practically always present though they are far more numerous at certain times than at others.

The results obtained may be summarised as follows.

SEREMBAN DISTRICT.

	Driving. Tins	Swarms	Poisoning. Swarms
April 27-May 10	390½	79	19
May 11-May 23	897½	167	26
May 25-June 6	1,236	175	53
June 6-June 20	392	72	20
June 20-June 27			7
	2,616	493	125

COAST DISTRICT.

April 27-May 9	403	113	
May 11-May 23	679	85	2
May 25-June 6	1,035	85	19
June 6-June 20	520	63	33
June 22-July 5	114	26	8
	2,751	372	62

TAMPIN DISTRICT.

May 1-15	2,748	145
May 15-30	3,360	159
June 1- 6	190½	14
	6,298½	318

This gives a total of about 11,665 tins of locusts destroyed by driving, respecting 1,183 swarms, while 187 swarms were poisoned.

In spite of this work the situation in the South of the Negri Sembilan is very disappointing as large swarms of fliers were reported to be present in June throughout the Tampin district and at the end of the month there were extensive areas containing eggs at Ayer Muria-land, Bukit Seriah and Ayer Kuning. Further breeding grounds are expected at Si Rusa, on the 17th-20th miles of the Port Dickson railway and near St. Leonards Estate. Ten swarms are known in the Seremban district, two being well on their way into the Jelebu district. It seems fairly certain that the large swarms bred inside the Malacca boundary near Tampin have all found their way into the Negri Sembilan or Johore, as Malacca was generally reputed to be fairly free from locusts in June, while large flying swarms appeared all over the Negri Sembilan, especially in the south east; at the same time other swarms were reported

to have crossed the Johore boundary. It is very probable that an immense amount of work will have to be done when hoppers next appear in the Negri Sembilan, but it would also appear that if they can be successfully dealt with, the number of locusts in the peninsula generally should be materially reduced, as on the whole the locusts appear to be concentrated at present (July 23) in the Negri Sembilan.

THE JERUSALEM ARTICHOKE IN MALAYA.

BY J. LAMBOURNE.

The Jerusalem Artichoke (*Helianthus tuberosus*) has been grown, by a few, in the Malay Peninsula for some years past, but it has never become as widely cultivated as it deserves. It is difficult to understand why this should be as the cultivation of this plant is of the easiest. Little cultivation is required beyond deep changkolling of the land before planting, and keeping down weeds until the plants are large enough to shade the ground.

The tubers are used as a vegetable. They are also used as a salad, either raw or cooked. They are popular with many Europeans, and as good vegetables are scarce this plant ought to be more widely grown than it is at present. The plants will grow in almost any situation but the best results are obtained when they receive liberal treatment in the matter of soil, and plenty of room to develop. The soil should be deeply cultivated and a dressing of well rotted cattle manure should be worked into the land a few weeks before planting.

The tubers should be planted in rows two feet apart. The best time for planting is just as the young shoots are appearing on the tubers. They may be planted before this with fairly good results but there is better chance of an even plant if the tubers have all commenced to grow before they are planted. They should be lightly shaded until the young shoots are well above the ground as they grow away more rapidly than if exposed to the full rays of the sun. The stems do not grow as tall as they do in more temperate climates but they usually flower freely which is the exception in England. When the plants are fully grown (about 4 feet in height) the leaves begin to wither and die. It is then that the tubers are ready for the table.

When Artichokes are grown for human consumption and where the demand is small it is not advisable to plant up a large area at one time, as the tubers soon become discoloured and uneatable if

lifted and stored, and if left long in the ground they commence to sprout again. To keep a succession of tubers it is necessary to plant up a small plot about once a month, thus a constant supply of young tubers may be obtained. Three to four months are usually required from the time of planting until the crop is available.

The tubers of the Artichoke grown in this country are much more branched than those grown in more temperate climates. This is probably due to climatic conditions being suitable for constant growth. In this country there is no decided change in season, so that the tubers do not undergo a resting period as is the case in countries where a decided change occurs.

In spite of the plant being smaller in growth, and the tubers more branched than in temperate climates, the yield is comparatively good. From a small plot grown on the Experimental Plantation Kuala Lumpur in fairly good soil an average of more than 3 lbs. per plant was obtained. The tubers were planted 2′ x 2′, the yield would therefore be about 13½ tons per acre. This yield is perhaps more than could be expected over a large area with poorer soil. However, judging from yields obtained in a smaller garden in "Carcosa" grounds, on comparatively poor soil, as much as 10 tons per acre could probably be expected from any ordinary well cultivated soil. That this yield is fairly good will be seen by a comparison with others from different parts of the world. In New South Wales 7-10 tons per acre* and in Poona† an average of 5 lbs. per square yard were obtained. This latter is approximately equal to 10¾ tons per acre. In America—the home of the Jeruslam Artichoke—considerably higher yields have been obtained by deep cultivation and manuring. Yields from 20-30 tons per acre are stated to have been obtained on Experimental Stations in the U. S. A. It is stated in the Experiment Station Record U. S. A. 1910 page 531 that as much as 38.9 tons of White Jerusalem Artichoke were obtained from sandy soil.

In addition to its use as a vegetable for human consumption the Artichoke is grown in some parts of the world as a field crop and the tubers are fed to Poultry, Cattle, Sheep and Swine.

Mr. T. Greiner** Vegetable Specialist La Salle N. Y. says that:—"All kinds of Farm animals are fond of the tubers. They may be ground and fed, mixed with ground grain, to Poultry with good results. As a succulent food for cattle, sheep, swine, and

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* W. H. Potts. "Pigs and their Management."

† Gardening in the Tropics by S. M. Woodrow P. 335.

* Cyclopedia of American Horticulture.

perhaps other form of stock this tuber seems to deserve more general attention."

Mr. W. H. Potts, Principal of Hawksbury College Experiment Farm Richmond N. S. W., in a work on "Pigs and their management" says that:—"Few foods are more relished by pigs. The tuber in the raw state is very nutritious more especially for pregnant sows and also sows reduced in weight and condition after sucking a litter. For feeding pigs it is best to turn them into the crop to root out the tubers. It must be remembered however that where it is desired to continue the crop the pigs should be removed before all the tubers are eaten.

"The outcome of a number of tests goes to show that for fattening purposes these tubers must be given with grain and have a similar result to feeding with potatoes. The average composition of the Artichoke is shown here in contrast with the potato:—

	Water	Ash	Protein	Carbo hydrate	Fat	Nutritious value
Artichoke	79·5	1·0	2·4	16·7	0·2	1: 7
Potato	78·9	1·0	2·1	17·9	0·1	1: 8·6 "

In conclusion I might mention that anyone wishing to take up the cultivation of this Artichoke on a small scale may obtain tubers from the Department of Agriculture, Kuala Lumpur. A very limited supply of tubers will in a short time be available for distribution.

MALAYAN RUBBER AND COCONUT SOILS.

BY M. BARROWCLIFF.

Paper submitted to the London Congress of Tropical Agriculture.

For the past 18 months the writer has been engaged solely in the examination of the soils supporting rubber, coconuts and rice in the Federated Malay States. Estates have been visited in nearly every district in the country and an endeavour made to obtain an insight into the relationship between the soil's productiveness and its mechanical and chemical composition.

The subject is one of great importance to agricultural interests: the land has no previous cultivation history, and has for the most part been claimed from the original jungle only within the last few years. The selections made during the "boom" may be likened to a lottery which is only now beginning to reveal its prizes—and its blanks; for in many instances it is apparent that the yields likely to be obtained will fall far short of the anticipated.

The difference between the best rubber land and the average indifferent may be put as at least 100%, in the case of coconuts at 300% or more; from which figures some idea may be gathered of what significance to the investor the choice of the land is.

There is however no doubt that many of the less suitable soils, both rubber and coconut, are open to vast improvement under proper treatment; but it is essential that this should be started whilst the plantation is young, so that an early recognition of the necessity is essential.

In the present paper is given an account of the conclusions the writer has reached on the points mentioned above, and a few observations on the selection of land. Finality is not claimed, as new points of view are continually presenting themselves; but it is hoped that these notes will serve for comparison with those forthcoming from other tropical countries in which perhaps knowledge of the subject is in a state more advanced.

It has not been possible as yet to undertake any bacteriological work, but it is hoped to do so later, as the solution of many problems of interest may be expected from this mode of attack.

To prevent confusion it will be convenient to keep separate the remarks on the composition of the rubber and coconut soils respectively; but as regards the methods of improvement that may be employed these are of a general nature and apply equally to both; they therefore will be dealt with at the end.

Rubber Soils.*

Mechanical composition:—The soils on which rubber is planted in the Federated Malay States may be divided into three classes; those composing the undulating land, rising up to 500 feet, that broadens down from the central range of granitic mountains; the flat low-lying land forming the plains and valleys and formed alluvially from the mountains; and the flat peaty coast soils, probably fairly recently laid down by the sea, and, at the time of reclamation, consisting of tidal mangrove swamp.

Of these the first and the last have produced the highest yielding estates; the first because owing to the light sandy nature and perfect natural drainage, deep and extensive rooting has been possible; the last when artificially well drained only and when sufficient organic matter is present to have the same effect as sand in rendering the soil light and porous. Where both these conditions are not fulfilled the land is far from being satisfactory and is in some cases proving a source of great anxiety to the planter.

* The methods of analysis adopted are those recommended by Hall and Russell.

The second class mentioned, the inland alluvial soil, is less suitable, not on account of any deficiency in plant food material, but because of its close and impermeable texture. It contains little organic matter, and large proportions of the silts and clay. Consequently even when adequately drained, root growth is restricted and is mainly confined to the surface. Such soils crack badly in dry weather and the trees suffer severely.

These observations must be regarded as being general only; hill soils of a clayey type are to be met with, as, on the other hand, are lowlying soils sandy in texture. In the following table are given the mechanical analyses of representative samples of the sandier soils, all being excellent yielders.

	1	2	3	4	5
Coarse sand	..	..	..	..	..
Fine sand	61·4	56·0	60·1	53·0	40·8
Silt	9·2	12·1	8·1	9·3	6·0
Fine silt	9·4	4·2	8·8	13·6	16·1
Clay	17·7	25·9	19·5	22·0	24·6
Humus	2·3	1·8	3·5	2·1	2·5

No. 1 is of the Government experimental plantation at Kuala Lumpur, where trees 12-14 years old, numbering now about 90 to the acre, are yielding at the rate of about 9 lbs. per tree per annum. The remainder are all from well known estates.

No. 2, on which are 11 year old trees, gives 600 lbs. per acre; Nos. 3 and 4, both 9-10 year trees, 500 lbs. approximately; and No. 5, where the age is eight only, 450 lbs.

It is seen that the proportion of sand to fine silt and clay ranges from 2: 1 and over in the first three to 1: 1 in the case of No. 5.

The sandiest soil under rubber the writer has had occasion as yet to examine contained no more than 71% of sand to 11·1% of clay and 6·9% of fine silt. The yield was poor but the chemical composition was poor too, and it would not be safe to regard this degree of sandiness as being one necessarily to be associated with diminished returns. No statement regarding the limit can therefore as yet be made.

The texture of typical alluvial clay soils, class No. 2, is shewn by the following figures. On land of this type eight year old trees are usually found to yield not more than about 250 pounds per acre, or 2 lbs. per tree.

	6	7	8	9	10
Coarse sand	..	..	..	..	..
Fine sand	19·3	13·3	2·4	21·2	3·5
Silt	10·4	28·7	13·5	44·5	19·9

Fine silt	21·7	21·5	31·0	16·8	33·8
Clay	46·6	34·5	50·4	16·0	38·8
Humus	2·0	2·0	2·7	1·5	4·0

No. 9 is an instance in which the closeness of texture is due to the large preponderance of silt; the growth here being exceptionally poor. In the other cases the predominance of the clay and fine silt fractions is such as in Europe would probably be associated with extreme infertility.

Stones and gravel are very rarely found in Malayan soils, in fact in most cases no material coarser than 0·5 mm. is met with.

Chemical Composition:—It seems characteristic of tropical soils that the analytical results afforded by even the most fertile of them are much poorer than those of temperate climates.

This is particularly noticeable when comparing the "available" amounts, of potash and phosphate; but no doubt the higher temperature and greater rainfall causes more rapid decomposition of the complex soil constituents, and also perhaps produces conditions more favourable for bacterial growth, so that the plant has always a sufficiency to draw upon.

Nitrogen:—The percentages of nitrogen in the ten soils whose mechanical analyses have been given are as follows:—

1	·091%	4	·114%	6	·20%	9	·078%
2	·090	5	·127	7	·19	10	·20
3	·177			8	·248		

Nos. 1 and 2 being the best yielders it is seen how little Nitrogen the rubber tree requires; in fact manurial experiments on No. 1 have shewn further addition of this element to have only a very slight effect, small though the quantity present is.

As analyses have indicated that in producing a crop of 400 lbs. of dry rubber only 3½ lbs. of nitrogen are taken away, it is not to be expected that very general resource to nitrogenous manuring will be necessary. Probably in the near future such treatment will only be required on hillsides damaged by wash and on old tapioca and possibly coffee land.

In no case has any relationship been traced between yield and nitrogen content.

Potash:—The same ten soils may be retained as examples throughout: the following table shews the amounts of potash they contain:—

POTASH.

	Total	Available		Total	Available.
1	·118	·0057	6	1·30	·0073
2	·142	—	7	·376	·009

3	·250	·0084	8	·65	·0096
4	·139	·0052	9	·36	·0086
5	·212	·0092	10	·459	·0081

The quantities present in the clay soils are, as was to be expected, greater. The lowest figure yet obtained for "available" potash is ·004%, and this was from a good yielding estate. No relationship between potash content and fertilization has as yet been traced, and it seems likely that in most types of Malayan soil sufficient is always present for the ordinary needs of the tree. In the prevention of the effects of drought however artificial potash fertilizing is effective even on a soil containing as much as ·015% "available," a phenomenon observed in other countries and with other crops.

Phosphate:—With the exception of the peaty soils, which will be dealt with in connection with coconuts, the soils in Malaya are markely deficient in this element. In those whose other analytical characteristics have been given are found:—

PHOSPHATE. (P_2O_5)

	Total	Available		Total	Available.
1	·023	·0029	6	·069	·0013
2	·059	—	7	·035	·0028
3	·045	·0020	8	·051	·0061
4	·045	·0022	9	·0133	·0020
5	·029	·0033	10	·032	·0029

Phosphate appears in fact to be the limiting factor and in all cases where differences of fertility not ascribable to texture or drainage have been noticed, they have been directly referable to the phosphate content.

Comparing soil 5 for instance with another from the same estate, of which the mechanical analysis is practically the same, which contains as much nitrogen and more potash and yet gives only 300 lbs. per acre in place of the former's 450 lbs. from equally old trees, it is seen that the available phosphate present in the worse yielding soil is only half that in the other (·0017 to ·0033). A field poorer still from the same place contained only ·0012% available.

Still it is not possible to lay down any rule as to the minimum quantity essential for a satisfactory yield as this must depend on the texture. In two soils the amounts of available plant food required to produce an equal effect may be assumed to be inversely proportional to the extent of root development attained by the trees in those soils, other conditions being equal.

Lime:—The hill soils normally contain from ·02 to ·10% of lime, the clay soils ·15 to ·30%. In rare cases only, usually coast soils, is up to 1% found.

Small though these quantities seem, they yet appear to be sufficient, except in the case of acidic peaty lands.

It is by no means proved that liming is necessary on the lighter soils, in fact on No. 1 it has been found to produce very little effect on the yield of the tree. On the clays however it is of benefit in improving the texture; in fact liming is the only measure capable of producing amelioration that has as yet been tried.

Coconut Soils.

Although native owned coconuts are to be found in every part of the country, on all classes of soil, those owned by European companies are, with a few exceptions, to be found on the more or less peaty lands lying along the West Coast. When well drained this soil proves itself admirably adapted to the cultivation; trees begin to fruit as early sometimes as 4 or 4½ years and by their eighth or ninth year are yielding yearly 60 to 80 nuts a tree.

These lands are characterised by being very clayey but containing a considerable quantity of organic matter, rendering them almost black in appearance. They are well supplied with nitrogen, and with potash and phosphate, both in the total and available forms.

Observations go to show that if badly drained they are infertile; but that for coconut the drainage need be less deep and thorough than for rubber.

Instances can be pointed to in which of the two cultivations growing side by side the coconuts are yielding magnificently, the rubber hardly at all.

Inland, the tree seems to prefer a soil of good open texture just as does Hevea, and on the heavy clays yields are poor, 20 to 30 nuts per annum.

The writer has not yet had an opportunity of visiting or examining any of the East Coast soils, on which the tree is reputed to give phenomenal yields when growing apparently out of pure sand. Such very sandy soils as have come under notice have been associated with extremely low yields, unless heavily manured.

The following are examples of some of the best West Coast soils.

MECHANICAL ANALYSES.

	1	2	3	4	5	6
Coarse sand	..	..	..	..	..	..
Fine sand	10·9	9·5	7·7	6·1	20·2	12·1
Silt	25·2	25·4	20·9	22·7	20·8	18·3
Fine silt	35·1	35·5	33·1	39·2	30·9	33·9
Clay	21·4	20·8	30·3	22·8	22·7	32·4
Humus	7·4	8·8	8·0	9·2	5·4	3·3

CHEMICAL ANALYSES.

	1	2	3	4	5	6
Loss on heating	16·4	19·4	13·1	16·0	15·9	10·9
Potash	·334	·224	·555	·29	·407	·345
Phosphate	·0085	·098	·076	·081	·064	·043
Lime	·20	·20	·24	·13	·13	·10
Magnesia	·35	·25	·40	·39	·16	·25
Nitrogen	·38	·446	·23	·463	·279	·174
Available Potash	·0085	·0420	·0196	·0150	·0333	·0347
Available Phosphate	·0223	·058	·043	·022	·0160	·0050

It is not possible to draw comparisons between these soils, owing to different ages of trees etc. Their yielding capacity is probably the maximum attainable.

Where differences of yield do exist they may be ascribed either to different cultivation policies or to variations in the degree of drainage.

It is not improbable that in all these soils the amounts of the various plant foods present are greater than the tree requires for the development of its maximum productivity.

More light on the relationship of soils to yield can be obtained from a study of some inland soils, analytical figures for which are given in the following tables:—

1. Good Soils.

	1	2	3	4	5	6	7
Coarse sand	..	..	..	..	..	..	29·4
Fine sand	69·6	62·4	83·9	73·0	70·0	72·3	38·2
Silt	6·6	6·7	6·3	2·1	4·9	4·1	3·7
Fine silt	7·9	18·2	4·5	11·1	9·4	5·3	7·8
Clay	13·9	11·1	3·8	12·2	14·0	15·3	19·3
Humus	2·0	1·6	1·5	1·6	1·7	2·0	1·6

2. Poor Soils.

	1	2	3	4	5	6
Coarse sand	..	..	..	7·7	26·3	20·7
Fine sand	83·8	91·0	87·8	59·6	36·1	28·1
Silt	3·5	1·6	2·2	6·4	4·3	3·2
Fine silt	5·6	4·9	3·4	11·3	8·2	7·7
Clay	6·2	1·5	5·4	13·7	23·5	39·0
Humus	0·9	1·0	1·2	1·3	1·6	1·3

Except for No. 2 in table II all these soils are seen to be of good texture, and no distinction between the "good" and the "bad" can be drawn. No. 3 of the "good" list for instance contains less clay than Nos. 1 and 3 of the "bad," which might otherwise have had their infertility attributed to lack of this substance.

Reference to chemical considerations must therefore be made to find an explanation for the differences.

The chemical analytical results afforded are seen in the next table:—

MECHANICAL ANALYSES.

1. Good Soils.

	1	2	3	4	5	6	7
Loss on heating	5·8	7·1	3·3	4·4	5·6	4·6	7·1
Potash	·06	·124	·103	·144	·053	·075	·153
Phosphate	·055	·044	·051	·0316	·0335	·059	·0473
Lime	·10	1·2	·09	·04	·08	·04	·02
Magnesia	·04	·03	·02	·05	·06	·05	·03
Nitrogen	·098	·080	·077	·080	·085	·10	·078
Available Potash	·0065	·0191	·0122	—	·0097	·0100	·0084
Available Phosphate	·0114	·0073	·0085	·0135	·0110	·0098	·0029

2. Bad Soils.

Loss on heating	2·3	2·5	3·3	4·1	7·7	9·8
Potash	·033	·021	·047	·140	·144	·128
Phosphate	·0087	·0086	·016	·029	·029	·0356
Lime	·02	·05	·17	·018	·02	·02
Magnesia	·10	·05	·20	·02	·02	·02
Nitrogen	·045	·062	·06	·06	·076	·068
Available Potash	·0020	·0043	·0042	·0500	·0080	·0073
Available phosphate	·0017	·0017	·0011	·0053	·0016	·0017

The first three of the latter series are probably deficient in all the plant food constituents, nitrogen, potash, and phosphate. On No. 1 are old trees yielding only a few nuts a year. No. 4 is well supplied with phosphate and potash but lacking in nitrogen; it has yielded during the past three years an average of 24 nuts per tree only. The average for No. 5 for the same period is 40 nuts;

this soil contains very little available phosphate, as also does No. 6, the average for which is 30 nuts per tree.

The soil in the first list are all excellent yielders, the trees giving 70 to 80 nuts a year. No. 3 in fact, which is manured regularly with cowdung, is stated to yield 100 nuts a tree. This soil is from a small native holding. None of these soils contain much nitrogen, the percentage being about the same as seemed sufficient in the case of rubber.

Potash and phosphate are present in all in good amounts. Soil No. 7 however in which the available quantity of the latter substance is less than in the others has for several years been showing a constantly diminishing yield, which has dropped from 80 nuts to 50.

Manuring coconut trees with salt is a very common practice amongst most Eastern races, and probably originated in the observation that trees planted by the sea so often do well. Although salt is not a necessity—many inland plantations to which it is never applied give high yields—it is undoubtedly in many cases beneficial. Probably its action is to increase in the soil the amount of "available" potash.

A much disputed point amongst coconut cultivators is whether to clean weed or to allow grass to grow. The writer's observations have led him to the conclusion that the latter practice is unsound; probably on the account of the formation of toxins, as demonstarted at Woburn and other places. On the other hand clean weeding has its disadvantages—the soil gets baked and loses its humus more quickly and on slopes loss results from wash.

A better practice would be to grow a leguminous cover crop, to be fed to cattle or turned in at the commencement of the dry season. The coconut tree suffers severely in times of drought and a timely mulch may have an effect of great importance on the ensuing season's yield.

An important feature about a coconut plantation is that the growing of such a crop is at all times possible. With rubber on the other hand after about the fourth year the shade is too dense to permit of anything being interplanted.

Soil Amelioration.

In the case of both cultivations the least suitable soils, and the ones most difficult to deal with, are the heavy clays that have been described.

Liming is one method of treatment, for the purpose of flocculating the clay particles and thus lightening and making more porous the texture. Lime however is in Malaya very expensive,

costing nearly £2. per ton; for the above purpose a large quantity is required, and altogether it is doubtful whether the results would justify the expenditure.

The other method of improving such a soil is by green manuring. This must however be started in the early days, when the trees are young, as only when light has free access to it can a cover crop be grown. No suitable plant that will grow in the shade has as yet been found. The seed should be sown at the commencement of the wet season, in September or October, and the crop forked in deeply about the following February. A second sowing might be possible in May, but one crop a year should be sufficient. Repeating this for three seasons, or as long as the shade is not too dense, will result in a large quantity of humus having been incorporated with the soil, rendering the texture lighter and more pervious, beside increasing the nitrogen content. A suggestion that seems well worth a trial is to dig narrow trenches three feet deep between the trees, and to bury cowdung, or, as this is rarely obtainable, a green manure, best together with some basic slag, in them, finally lightly replacing the soil. These places, to which the young rootlets will rapidly be attracted, will serve as ventilating shafts, and should have a beneficial effect on the health of the tree.

Another serious question is that of the prevention of wash. It is not uncommon to see numerous deep furrows cut by the rain water running down the sides of hills planted with rubber from which the surface soil is obviously being rapidly eaten away. Here again a cover crop will prove of great value; but the best preventive undoubtedly is to terrace.

The high cost is the argument used against this operation; but those who have carried it out hold the opinion that this will be adequately compensated for by the greater rate with which the coolies will be able to tap when the trees come into bearing.

PRELIMINARY LIST OF INSECTS COLLECTED IN THE FEDERATED MALAY STATES.

BY C. B. HOLMAN HUNT.

(*Continued.*)

The following Carabid was omitted from the list last month.

Pheropsophus occipitalis, var, McLeay, Batu Caves, Selangor. Plains. And the name of the first Lucanid on the List should be castlenaudi and not castlenaui.

Dytiscidae.

Cybister tripunctatus, Oliv.		Plains.
Hydaticus vittatus, Fab.		Plains.

Hydrophilidae.

Sternolophus nr. rufipes, Fab.		Plains.

Staphylinidae.

*Philonthus fimetanus, Gravely.		Plains.
*Philonthus sp.		Plains.
Paederus fuscipes, Curt.	Parit Buntar, Perak.	Plains.
Lathrobium sp.		Plains.

Nitidulidae.

Carpophilus foveocollis, Murn.	Caledonia Est. Prov. Wellesley.	Plains.
Amphicrossus disclor, Erich.		Plains.
*Brachypeplus between. { orientalis, Musc. / obesus, Grom.	Caledonia Est. Prov. Wellesley.	Plains.

Cucujidae.

Silvanus nr. unid ntatus, Fab.		Plains.
Laemophlaeas pusillus, Schon.		Plains.

Erotylidae.

Tetralanguria elongata, Fab.	K. Lumpur, Selangor.	Plains.
Tetralanguria elongata, var.	Maxwell's Hill, Perak.	3400 feet.
Episcapha 4-maculata, Wiede.		Plains.
Aulacocheilus janthinus, Lacard.	Batu Tiga, Selangor.	Plains.
*Pseudotritoma, sp.		Plains.

Coccinellidae.

Alesia discolor, Fab.	Parit Buntar, Perak.	Plains.
Coccinella transversalis, Fab.		Plains.
Chilomenes 6-maculata, Fab.		Plains.
*Ithone 12-spilota, Hope.	Maxwell's Hill, Perak.	3400 feet.
Caelophora bisellata, Muls.		Plains.
Caelophora inaequalis, Fab.	K. Lumpur, Selangor.	Plains.
Neda 16-notata, Fab.	Maxwell's Hill, Perak.	3400 feet.
Chilocorus nigritus, Fab.		Plains.
Scymnus sp.		Plains.
Epilachna indica, Muls.	Butu Tiga, Selangor.	Plains.

Endomychidae.

*New genus (nr. Mycetina ?)		Plains.
*Pdanus gerstaeckeri, Gorh.		Plains.
Stenotarsus pantheiinus, Gorh.		Plains.

Byiihidae.

*New genus. Very interesting, with lobed tarsi.		Plains.

Malacodermidae subfamily.?

Prionocerus sanguinea, Schaus.		Plains.

Lycides.

*Trichalus niger, Waterh.		Plains.
*Trichalus communis, Waterh.	Batu Tiga, Selangor.	Plains.
*Cantires nr. congener, Waterh.	Batu Tiga, Selangor.	Plains.
*Metanaeus dispar, Waterh.	Batu Tiga, Selangor.	Plains.
*Ditonecces sp.		Plains.
Taphes between { brevicollis, Waterh. / frontalis, Waterh.	Batu Tiga, Selangor.	Plains.
*Micronychus nr. vestitus Waterh.		Plains.
Genus ?		Plains.

Lampyrides.

Pyrocoelia terminata, Gorh.	Batu Caves, Selangor.	Plains.
Pyrocoelia ?	Maxwell's Hill, Perak.	3400 feet.
Luciola pallescens, Gorh.	Gap, Selangor-Pahang.	Plains.

Telephorides.

This family is in course of arrangement at the British Museum and, although 12 different species were recognised as different in the Malayan collection, only one was identified, namely:

Ichthyurus pachygaster, Gestr.	Bukit Kutu, Selangor.	3300 feet.

Melyridae.

*Attalus sp.	Parit Buntar, Perak.	Plains.
*Genus nr. Carphurus.		Plains.

Cleridae.

*Tenerus between { siamensis, Gorh. / melanurus, Gorh.		Plains.
Clerus cicindeloides, Gray.		Plains.
*Calimerus sp.		Plains.

Lymexylonidae.

*Attractocerus emarginatus, Castlen.	Maxwell's Hill, Perak.	3400 feet.

Dascillidae.

*Lichas sp.		Plains.

Eucnemides.

*Trixagus sp.		Plains.
Hodoceras malaisiensis, Bouv.	Batu Tiga, Selangor.	Plains.

Elaterides.

Alaus lacteus, Fab.	Riverside Est. Selangor.	Plains.
Alaus putridus, Cand.		Plains.
Alaus lophura, Cand.		Plains.

Anathesis laconoides, Cand.	Batu Tiga, Selangor.	Plains.
*Megapenthes ebriolus ? Cand.	Gap, Selangor-Pahang.	2700 feet.
Megapenthes biloesus, Cand.		Plains.
*Diploconus carneus, Cand.		Plains.
*Diploconus carneus, black var.	Batu Tiga, Selangor.	Plains.
*Melanotus nr. cuneolus, Cand.		Plains.
Hemiops crassa, Gyll.		Plains.
Elias umbilicatus, Cand.	Bukit Kutu, Selangor.	3300 feet.

Buprestidae.

Catoxantha opulenta, Gory.	Batu Caves, Selangor.	Plains.
Cyphogastra ventricosa, Oliv.		Plains.
Chrysobothris ellyptica, Deyr.		Plains.
Iridotaenia mirabilis, Sap & Gory.		Plains.

Tenebrionidae.

Setenis coracina. Knock.		Plains.
Setenis semisulcata. Burm.	Kuala Lumpur, Selangor.	Plains.
Setenis impressa. Burm.	Riverside Est. Selangor.	Plains.
Encyalesthes ?	Batu Tiga, Selangor.	Plains.
Camaremena ? or Strongylium ?	Bukit Kutu, Selangor.	3300 feet.
Anthracias gazellae, Fab.	Batu Tiga, Selangor.	Plains.
Charyotheca sp.	Batu Caves, Selangor.	Plains.
Platydema sp.		Plains.
Platydema nr. scriptipenne, Fairm.		Plains.
Amarygmus sp.		Plains.
Artactes marginicollis, Fairm.		Plains.
Leiochrinus rufofulvus. Westw.		Plains.

Cistelidae.

Cistelomorpha calida	Gap, Selangor-Pahang	2700 feet.
Allecula sp.		Plains.

Lagriidae.

*Lagria sp.	Bukit Kutu, Selangor.	Plains.
*Lagria sp.	Batu Tiga, Selangor.	Plains.
*Casnonidia sp.		Plains.

Othniidae.

Othnius between {delusus Pasc. / lynceus, Pasc.}		Plains.

Anthicidae.

Leptaleus trigibber, Mars.		Plains.

Oedemeridae.

Genus near Oncomera.	Gap, Selangor-Pahang.	2700 feet.
Genus near Oncomera.	Maxwell's Hill, Perak.	3400 feet.
Genus near Sessinia.	Maxwell's Hill, Perak.	3400 feet.

MORDELLIDAE.

Mordella composita, Walher.		Plains.
Mordella sp.		Plains.
Mordella sp.	Batu Tiga, Selangor.	Plains.
Mordella sp.	Batu Tiga, Selangor.	Plains.
Mordella sp.	Batu Tiga, Selangor.	Plains.

CANTHARIDAE.

Epicauta ruficeps, Illig.		Plains.
Zonitis straminea var, Fairm.	Gap, Selangor-Pahang.	2700 feet.
Zonitis sp.	Gap, Selangor-Pahang.	2700 feet.

(To be continued.)

DEPARTMENT NOTES.

Mr. J. Grantham has been appointed as 3rd Assistant Agricultural Chemist, Department of Agriculture F. M. S., Kuala Lumpur.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon, during the Years 1914 and 1913.

Destination.	Exported during April, 1914.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.	Decrease.	Value of rubber exported, 1914.	Duty collected, 1914, to date.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	$	$ c.
Straits Settlements ...	1,127.50	4,989.76	6,117.26	3,472.67	2,644.59	...	10,955,712	272,279.81
United Kingdom ...	795.25	3,678.02	4,473.27	4,221.78	251.49	...	8,113,240	202,831.00
Continent of Europe ...	97.73	443.02	540.75	527.75	13.00	...	997,548	24,938.70
Ceylon	48.07	264.18	312.25	255.21	57.04	...	349,907	8,747.67
Other Countries ...	...	100.27	100.27	...	100.27	...	413,498	10,337.45
Total ...	2,068.55	9,475.25	11,543.80	8,477.41	3,066.39	...	20,829,905	519,134.63

KUALA LUMPUR,
6th June, 1914.

H. W. FIRMSTONE,
Acting Commissioner, Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the Month of May, 1914.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	149.	84.1	93.83	75.38	18.45	79.1	.891	75.8	.76%	...	3.35	1.17
Malacca, Durian Daun Hos.	29.863	152.5	84.4	89.9	72.6	17.3	81.	.999	...	.85	N.	1.99	.45
N. Sembilan, Dist. Hospital Seremban	...	149.6	81.	90.4	72.6	17.8	76.5	.831	73.6	.78	N.W.	4.52	1.12
,, Dist. Hos. K. Pilah	...	155.	83.	...	...	...	79.2	.927	76.7	.81	...	2.35	.80
,, ,, Tampin	...	146.5	83.4	...	...	...	77.6	.840	73.9	.74	...	2.91	.63
,, ,, P. Dickson	...	162.5	85.1	90.5	76.4	14.1	79.2	.883	75.4	.73	...	2.09	1.06
Pahang, ,, K. Lipis	...	...	83.5	92.2	72.9	19.3	76.9	...	...	...	...	4.49	1.65
Penang, ,, Penang	29.849	145.4	84.9	91.2	74.5	16.7	78.9	.908	72.5	.75	...	7.36	1.71
Perak, ,, Taiping	...	110.	83.89	96.	67.	29.	78.29	.891	...	.77	...	6.47	3.67
,, ,, Ipoh	...	...	84.33	96.	71.	25.	78.14	.881	...	.75	...	3.40	1.74
,, ,, T. Anson	...	...	83.53	95.	72.	23.	79.26	.942	...	.83	...	8.50	1.80
,, ,, P. Buntar	...	...	84.18	95.	73.	22.	78.74	.910	...	.79	...	8.82	3.80
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	5.44	1.13
Selangor, General Hospital Kuala Lumpur	...	122.1	81.4	90.5	70.8	19.7	78.1	.895	75.8	.83	...	2.19	.59
,, Dist. Hos. Klang	...	...	83.6	90.7	76.3	14.4	79.1	...	...	...	...	7.66	2.32
,, ,, K. Selangor	...	...	...	89.1	75.7	13.4	...	...	...	...	...	1.49	.56
,, ,, Rawang	...	...	...	93.1	73.5	19.6	...	...	...	...	...	2.47	.72
Singapore, Kandang Kerbau Observatory	29.883	160.	85.6	97.	73.	24.	78.3	.932	...	77.	S.E.	2.74	.86